

*General Taylor
Schuettebury NY*

July 23, 1959

Mr. G. A. Derbyshire
Space Science Board Secretariat
National Academy of Sciences
2101 Constitution Avenue
Washington 25, D. C.

Dear Mr. Derbyshire:

I am returning your draft notes on the July 8 meeting with a few pencil marks and the following comments.

On page 3, I think the second paragraph should be expanded somewhat as follows: It was noted that sterilization may be accomplished by 1) heat, 2) chemical means, or 3) radiation. Thermal sterilization is more effective if performed with steam than if performed dry. In the former case, temperatures in the order of 120°C are adequate whereas for dry treatment $160^{\circ}\text{--}170^{\circ}\text{C}$ is required. There is a time temperature relation and flash temperatures even greatly exceeding these limits will not be effective. Chemical sterilization, particularly using ethylene oxide as described later, appears very effective wherever the gas can reach possibly contaminated surfaces. Radiation may be the last resort for components which are hermetically sealed and which will not stand thermal sterilization.

Dr. Davies' list of components used in Explorer IV showed a number which could not stand sterilization by thermal means and, while many of these could no doubt be sterilized chemically, such items as transistors, sealed capacitors, etc. may require radiation treatment unless they could be assembled originally in a sterile condition. It appeared evident from these discussions that none of the methods should be excluded from consideration.

On page 4 under Conclusions, I would suggest the following:

1. That there is insufficient information available on the chemical composition of the components used in space probes (this includes knowledge as to whether the materials themselves are bactericidal.
2. There is no information on the contamination level of parts or sub-assemblies or a complete payload as it exists under present procedures.

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3. Sterilization of space probes should be feasible and--with proper attention to production, shipping, and assembly, plus a final ethylene oxide "fumigation"--relatively simple.
4. In view of the potential scientific importance, and in view of the opinion expressed under 3. above, efforts should be made to sterilize all space probes including those intended for moon shots.
5. Whatever sterilizing means are used must be compatible with the operation requirements of the device.
6. In view of the competence available at Ft. Dietrich, this organization is eminently qualified to assume technical leadership in determining sterilization requirements and developing the necessary procedures.
7. The organization responsible for producing a space probe must, of course, retain responsibility for assuring itself that sterilization procedures are compatible with engineering and operational requirements.

Under Recommendations, I believe that items 2, 3, and 4 accurately represent the consensus of the meeting. However, recommendation 1 should be amplified by adding item "(d) the compatibility of sterilization procedures with design, procurement, and assembly procedures, as well as possible effects on reliability of performance". As I recall, Dr. Phillips indicated that he would be agreeable to spending "transferred funds" on this project. This means that we should recommend action by appropriate administrative procedures to implement the establishment of a program. In other words, is not our recommendation that NASA undertake to "hire" the services of Ft. Dietrich for carrying out the program?

As a matter of good practice, I would think that the program should include an initial phase in which all of the problems would be listed and defined, and a plan developed for obtaining solutions. This would probably result in a definition of a number of tasks which could then be properly assigned and funded. I would think that this "Phase I" should be reviewed for adequacy by a group--possibly such as the one we had at the meeting--but in any case, representing both the biological and engineering viewpoints.

Just as an example, it would seem to me that the "slight crazing" of plastics occasionally observed with ethylene oxide treatment and, for that matter, with

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penetration of ethylene oxide into rubbers and plastics, must be investigated for possible effect on reliability of performance. I gather Ft. Dietrick has studied the effect on mechanical properties and maybe information exists on possible effects of electrical properties such as resistance, dielectric strength, etc.; however, this must be nailed down when we are seeking a degree of reliability required for operations in space.

Since I may have read more into the subject than was actually discussed at the meeting, I am taking the liberty of marking the other members of the panel for copies of these comments.

Please let me know if you have any questions.

Very truly yours,

Original signed by
G. W. DUNLAP

G. Wesley Dunlap, Manager
ENGINEERING PHYSICS & ANALYSIS LAB.

GWD:EK

cc Dr. Joshua Lederberg - Stanford University ← THIS COPY FOR ←
Mr. R. C. Baumann - NASA, Washington
Dr. Richard Davies - Jet Propulsion Lab.
Dr. C. R. Phillips - Fort Dietrick